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Rainio, Riitta

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Riitta Rainio (FI) and
Annemies Tamboer (NL)
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In one of the Late Mesolithic graves at Skateholm, Sweden, dating from 5500–4800 BC, was buried a woman together with a newborn baby. Altogether 32 perforated wild boar (*Sus scrofa*) teeth, along with traces of red ochre pigment, were found in this grave. We interpreted these artefacts as a rattling ornament decorating a baby pouch of leather coloured with red ochre. We made an experimental reconstruction and found out that the tooth pendants rattle against one another when the pouch is carried, for example, rocked to and fro. The reconstruction currently is on display in the *European Music Archaeology Project*'s travelling exhibition on archaeological instruments.

Introduction

Strung rattles of teeth, hooves, claws, beaks, shells or other hard objects are found across the globe. These sound instruments, which are often suspended from different parts of the body or clothing, shake during the wearer's movements and produce a rattling sound (Sachs, 1929, pp.8–9; Blades, 1970, pp.36–37). Portable percussion instruments like this call forth rhythmic movements and, almost automatically, a musical pulse. Among natives of Alaska, British Columbia and Hawaii, for example, rattling necklaces, belts, aprons,

mittens, and leggings were used to highlight dancing (Krause, 1885, pp.140, 168, 202; Ho'oulu Cambra, 1984a; 1984b; BM, 2016; NMAI, 2017; NMNH, 2017). Traces of similar rattles can also be found in prehistoric archaeological contexts. Mesolithic and Sub-Neolithic graves in Northern Europe often contain perforated or grooved animal teeth, which appear to form rows or bunches on the head, chest, arms, hips, or legs of the deceased (Stenberger, 1943; Gurina, 1956; Jaanits, 1957; Janzon, 1974; Zagorska and Lõugas, 2000; Burenhult, 2002; Zagorskis, 2004; Larsson, 2006). Although vegetable fibres and leather components are missing from these graves, it seems obvious that the tooth pendants were strung like beads or suspended from the accessories or clothing. Sometimes the remains of shells, hooves, or beaks can be found in the same sets (Petersen, 1990, pp.32–33; 2015, pp.93, 147–149). Use-wear analyses of approximately 150 tooth pendants from Ajvide, Sweden (3200–2300 BC), and Yuzhniy Oleniy Ostrov, Russia (7000–6200 BC), provide concrete evidence in support of the rattle hypothesis. Polish around the perforations suggests that the pendants hung more or less freely in their suspension loops, while pitting in the lower parts suggests that the pendants bounced back and forth and struck one another (Rainio & Mannermaa, 2014; Rainio, *et al.*, 2015). As evidenced by experiments with fresh animal teeth, collisions of this type between adjacent pendants must have generated a rattling sound.

This paper reports on the making of both experimental and experiential tooth rattle reconstructions that we designed and crafted in 2014 on the model of prehistoric finds. To our knowledge, the reconstruction is the first of its kind. It was made to order for the *European Music Archaeology Project*, which aims to recreate the sounds and music of ancient Europe by producing reconstructions and replicas of archaeological instrument finds (EMAP, 2017). The products of the project, funded by the Culture Programme of the European Union, are featured in a travelling multimedia exhibition in six European countries between 2016 and 2018. After sieving through a number of potential tooth pendant finds from Scandinavia, the Baltic Countries and Russia, and weighing their pros and cons from the perspectives of implementation, scientific precision and display, we decided to reconstruct the tooth ornament found in grave 6 at the Late Mesolithic site of Skateholm, Sweden. On the basis of the sources available to us, this ornament appears to have belonged to a baby pouch or sling, an accessory seldom described in the archaeological literature. Thus, the reconstruction reported here not only recreates the sounds and sonic experiences of the Late Mesolithic people at Skateholm, but also provides an insight into the nursing and bonding activities practised by them. More generally, the paper aims to bring strung rattles up for discussion concerning the instruments of the Stone Age.

Original Find at Skateholm

The Late Mesolithic site of Skateholm (5700–4000 BC) is a settlement and cemetery complex on the coast of Scania in Southern Sweden. It is comprised of 87 graves (5500–4800 BC) containing skeletons of females and males from all age groups, as well as of dogs. The site was excavated in the 1980's with several articles published by Lars Larsson (1980; 1981a; 1981b; 1982; 1983; 1984a, 1984b; 1984c; 1985; 1988), however the final report of the project is yet unpublished. As usual in the cemeteries of the Mesolithic,

many graves at Skateholm contain animal tooth pendants, often in great numbers. Dozens of perforated red deer (*Cervus elaphus*), European elk (*Alces alces*) and wild boar (*Sus scrofa*) teeth can be found on the skulls, chests, arms or hips of the deceased, suggesting that the pendants were originally attached to headbands, necklaces, sleeves and belts. According to Larsson (1982, p.13; 1983, p.20; 1984a, pp.67–68, 72; 1984b, p.30; 1988, pp.125–134), the most accurate information can be obtained about the belts or some type of hip ornaments. In at least six graves, the tooth pendants form a row or a couple of overlapping rows, which encircle the hips of the deceased, but leave the front side uncovered. The front was obviously reserved for a fastening system. In grave VIII, this type of ornament is comprised of more than 100 red deer teeth; in grave XXII, it is comprised of approximately 40 red deer, European elk and wild boar teeth. In addition, the latter ornament includes two perforated mustelid jaws and several unperforated teeth.

At first sight, the chosen ornament in grave 6 appears to have been a similar belt or hip ornament (See Fig. 1). The grave contains the body of a 25 to 40-year-old woman in a sitting position, with the lower limbs extended and the upper part of the body collapsed during decomposition (Larsson, 1980, pp.28–30; 1984b, p.20, Fig. 7; 1988, pp.132–133). At her waist, there is a concentration of 32 perforated wild boar teeth lying in two or three superimposing rows. An unperforated elk tooth also belongs to the set, as well as red ochre stains that spread from the waist over the chest and thighs (Åkesson, 2007, Appendix 1). A dark stain by the legs is a concentration of fish bones. Oncloser inspection, however, the belt as an option begins to appear unlikely (See Fig. 2). Contrary to the hip ornaments described above, the tooth pendants in this grave lie in the front of the body, and beneath and beside them there is also the remains of a prematurely born baby or fetus. According to Ove and Evy Persson's osteological analysis (1984, pp.13–16), some of the tooth pendants can even be found beneath the child's remains, that is, between the child and the sitting woman. This suggests that the baby really was born and buried in the lap of its mother, who probably died of natal complications (See Fig. 3). It also suggests that the tooth pendants were actually associated with the baby and attached to something that was wrapped around it. The taphonomic analysis of grave 6 points to the same direction. According to Liv Nilsson Stutz (2003, pp.276–278), the vertical collapse of the upper part of the woman's body could be explained by the existence of an empty space, which formed when something organic and voluminous decomposed in a lower part of the grave. As there are no other artefact remains in the grave, this organic and voluminous matter could well have been the artefact decorated with the tooth pendants and wrapped around the baby. A plausible and practical wrapping in a Mesolithic society was a baby sling, a pouch used for carrying babies. The flexed arms of the woman and the relatively high position of the tooth ornament at the waist-level—in the arms rather than on the legs—appear to support this interpretation. As such, the tooth ornament suggests that the wrapping was not a just casual bundle.

Baby Slings and Red Ochre

The artefact of organic matter in Skateholm grave 6, now decomposed, is interpreted here as a hypothetical baby sling with a tooth ornament. As we have circumstantial evidence only for the sling, its reconstruction is worked out on the basis of assumptions. The tangible result is an experimental type model, its developing process being at the same time an aid in exploring concepts and ideas (Hurcombe, 2008, p.83). As far as we know, no baby slings or other devices to carry a baby are known from the Mesolithic, Neolithic or later archaeological record. Historical and ethnographical sources are consulted in order to imagine what this Late Mesolithic sling could have looked like.

Possibly the oldest sources, and at the same time rare examples, for the existence of baby slings in the Western world are two frescoes depicting the Flight into Egypt of Giotto di Bondone (circa 1267–1337), one in the Capella dei Scrovegni, Padua (1304–1306) (Van Hout, 1993, p.7), the other in the Lower Church of the San Francesco, Assisi (1315–1320). In both, Mary is riding a donkey, her arms bent around the infant Jesus who is secured to her chest by a sling. This is a simple cloth band fastened with a knot that is visible just below Mary's shoulder. A baby sling is but one of several different types of baby carriers. Inflexible carriers as the cradle-like devices or basketry backpacks are carried on the back, those of pliable materials, cloth, plaited cord or leather, can be shaped for carrying on the chest or on the back. Native American mothers of the Central Plains used small wooden cradles as well as soft pouch-like carriers. In museum collections the decorated hoods of these little known soft carriers are kept, some of these carrying rattling fringes (Greene, 1992, p.97). The choice of material is in large part determined by the climate the sling is used in. In tropical climates a loosely plaited sling from vegetable cord seems most comfortable for a baby, but in Africa thin leather carriers are used as well. The way the arms of the mother in Skateholm grave 6 are bent around the baby, suggests it was enfolded in a pliable carrier. Considering the climate, this carrier was probably made of leather. The presence of red ochre speaks for leather too, as described below. The position of the tooth pendants mostly on top of the baby suggest that this carrier was a sling in the shape of a pouch, the teeth being attached to the upper rim.

Aside from the types of baby carriers that became popular in the West in the second half of the 20th century, most carriers around the world are amply ornamented and hung with decorative objects that have a symbolic, often a prophylactic meaning. An example of the last are the tiger and leopard teeth pointing menacingly outwards on the baby carriers of the highest ranks in Timur, Indonesia, undoubtedly not just a decoration showing off wealth, but at the same time warding off evil forces (Van Hout, 1993, p.104). Sometimes specific objects are chosen and fastened in a way to produce sounds, like the decorated bone pendants fastened to the tsompirontsi sling of the Asháninka of Peru, the tubular beads ending in shells that dangle against each other in an African animal skin carrier from Cameroon, or the large snail shells touching each other in an example from Malaysia (Van Hout, 1993, pp.16, 44, 84, 101). The sounds produced do not only constitute a reassuring rustle, but also have the purpose of warning off spirits and evil forces (Van Hout, 1993, p.86). The sounds of the 32 wild boar teeth on the Skateholm pouch sling presumably did so, too.

In Skateholm grave 6, red ochre stains spread from the woman's waist to the chest and thighs. Our interpretation is that these stains did not originate by sprinkling over the body, but derived from a baby carrier painted in ochre (cf. Larsson, 1988, pp.146, 159). Ochre was used by humans at least 77,000 years ago, as witnessed by thousands of worked pieces of red ochre found in the Blombos cave near Kaapstad, South Africa (Rifkin, 2011). In many Mesolithic and Neolithic graves in Europe and around the Baltic Sea, red ochre is found on buried bodies and in some cases even burial sites are sprinkled with it. In some of the graves, this use of red ochre is interpreted as having a symbolic meaning, red being a colour symbolizing blood and life in many cultures (Hovers, et al., 2003, pp.493, 509). Just the same we can assume that more mundane utilizations were at least as important (Rifkin, 2011, p.151). From the archaeological record we know of the use of red ochre as paint in caves. Occasionally discovered traces of red ochre on end scrapers and blades have been interpreted as evidence for cutting of leather processed with red ochre (Watts, 2002, pp.3–4), and ochre stained awls found in Blombos Cave may have been used to perforate ochre covered leather prior to sewing (Rifkin, 2011, p.135). Modern hunter-gatherers are known to use ochre as a food preservative, skin protector, insect repellent, medicine, and as an ingredient to process and preserve animal hides (Rifkin, 2011, p.132). Ochre is a designation for any earth containing iron oxide – hematite, goethite, lemonite etc. – and can be processed to obtain the desired colour shade. Red ochre earth can be heated to deepen the shade, while yellow ochre will turn red by heating. The efficacy of ochre as a leather tanning agent has been contested, but it does curb bacterial production and certain types of ochre make unprocessed animal hide resistant to putrification (Rifkin, 2011, pp.131, 147, 149). For instance, it is used by Ovashimba women of northern Namibia to slow down the decomposing process of leather by rubbing a fat and ochre mixture onto leather garments every few days (Watts, 2002, p.3; Rifkin, 2011, p.149).

The ochre probably was used for its decorative value too, a deduction that can be made safely when the ochre is applied to one side of the hide only. An ethnological example is a Native American ceremonial bison robe of 1830 in the Ethnological Museum, Berlin, that probably was smoke-tanned and afterwards painted with ochre on the outside (See Fig. 4 and 5). This was probably done on purpose on one side only to prevent the ochre of rubbing off on the person wearing the robe. We assume that for the same reason the red ochre on the Skateholm sling was applied on one side only. As the actual reconstruction was meant to be an exhibit travelling for a few years, it should require no maintenance like being rubbed with ochre fat every few days. Hence a tanned red deer (Cervus elaphus) skin was chosen as material for the sling (vegetable tanned), to be coated with red ochre paint. The use of butterfat and other animal body fats or vegetable oils as a medium for the paint being not practical in an exhibition setting, the red ochre powder was mixed with egg yolk. This is a natural oil-in-water-emulsion, consisting of about 51% water, 15% albumin, 22% oil, 9% lecithin, 1% minerals and 1,5% other substances. The lecithin is the emulsifying agent, active too when the yolk is mixed with other ingredients. After vaporization of the water, the oil hardens by polymerization, enclosing the ochre particles with a protective film (Borradaile and Borradaile, 1982, p.156). The yolks of ten chicken eggs in total were used for the whole hide, but it appeared eight probably would have been sufficient. In prehistory, when hens were not yet introduced, sea bird or duck, goose and

swan species eggs, collected in spring, could have been used. The yolks of the chicken eggs were lightly rubbed by rolling between the hands in order to remove adhering egg white and punctured to let pour out the liquid yolk, as the membrane will not dissolve. Water was added and some acid juice to make the emulsion easier to paint with, as well as some drops of clove oil, a very effective method of preservative that was unknown in prehistory, but added in view of the exhibition.

The pattern for the pouch sling was designed by combining features of a Sioux-type soft cradle pattern (Greene, 1992, Fig. 6) and a simple type of modern cloth baby sling pattern, in which the upper part is folded to strengthen the strap worn round the shoulders. The pouch part of the Skateholm reconstruction pattern is in one piece with the straps, by which just one seam is needed to close the strap (See Fig. 6). Deer hide is too thick to be folded and is in itself strong enough to function as a band, especially when using the part from the spine of the animal for the strap. The sides are pliable and supple, perfectly suited to fold around a baby (See Fig. 7). To strengthen, and at the same time decorate the rims, thongs of uncoloured red deer hide were laced through. This was inspired by the Bronze Age leather salt carrier bags excavated from the salt mines in Halstatt, Austria. The rim of the opening on top was folded double and laced to make the rim rigid, staying wide open when it was filled with spoils (Barth, 1992; NHM, 2017).

Preparing the Tooth Pendants

A major reason for choosing the Skateholm tooth ornament for reconstruction was the fact that it contained 32 wild boar teeth. This was a reasonable number of specimens and a suitable species from the perspective of implementation. However, full osteological analysis of this ornament has not been published. Of the 23 teeth that Persson and Persson analysed (1984, p.16), 19 were incisors I1 and I2 and four were canines. All analysed teeth originated from the lower jaw. Equal proportions of incisors I1 to I2, and of incisors sinister to dexter, suggest that all four incisors from the tip of the wild boar jaw were used for this ornament. In the Mesolithic, these straight and long incisors were often turned into pendants (cf. Burenhult, 2002; Zagorskis, 2004, p.58). Furthermore, a total of six specimens of incisor I1 dexter indicates that the raw material was extracted from at least six animals. A pair of identical and similarly worn canines obviously originated from the same individual. The absence of sex determinations in Perssons' analysis is unfortunate, because female and male canines of wild boar are very dissimilar in size. While the male canines grow into huge 10–12-cm-long tusks, the female canines are more proportional to the incisors I1 and I2, that is, 5–7 cm long.

For the reconstruction, we ordered lower jaws of seven animals from the wild boar farm Koivikkonotko (http://www.koivikkonotko.fi/) in Eastern Finland, receiving five female jaws and two male jaws. To extract the teeth, we soaked the fresh jaws in a water bucket for 4–5 weeks. After gums and periodontal tissues had decomposed, incisors and canines could be pulled out easily (See Fig. 8). Molars with forked roots, however, remained stuck in their place. To perforate the teeth, we used both flint blades and modern needle-point files. The latter were used to spare the worker's hands as they appeared to produce right type of perforations, around 2 mm in diameter. The point of the tool was rotated on two opposite sides of the root until it reached the root canal (See Fig. 9). This took 10–30

minutes. Young animals' teeth with wide root canals were clearly easier to work with. Finally, to follow the example of the wild boar tooth pendants from Ajvide, studied earlier traceologically (Rainio & Mannermaa, 2014), the root tips of the incisors I1 and I2 were sawn off with flint blades and modern files. These 3 to 5-mm-long sections form unnecessary projections, as they are too narrow to receive a perforation. Their crooked form might also hinder the movements of the pendants, when the pendants hang side by side in a row.

In the original Skateholm ornament, the 32 tooth pendants are arranged in two or three separate rows, but the accurate sequence of the teeth is not documented or published. This gave us a freedom to proceed. For the reconstruction, we decided to use 28 incisors I1 and I2, and four female canines, because these canines are fairly similar in size to the incisors I1 and I2. Together these teeth make up an even row. We also decided to arrange the teeth in two overlapping rows, and to follow the example of the tooth ornament in Skateholm grave VIII, where the teeth are arranged according to their natural position in the jaw (Larsson, 1988, p.128). According to this arrangement, the incisors I1 from the tip of the jaw are gathered in the middle of the row, whereas the incisors I2 from more distal parts of the jaw are placed in both margins. The canines from the sides of the jaw are then placed at the utmost ends. This arrangement aggregates teeth of similar shape and size next to each other and creates a symmetrical and balanced row (See Fig. 10). It also evokes the sense of a mouth: an enormous, menacing wild boar jaw wide open. Also, other well-preserved tooth ornaments at Skateholm, Ajvide and Vedbaek (6200–4000 BC) suggest that the order of the teeth was well thought out (Lindqvist, 1997; Strassburg, 2000, p.195; Petersen, 2015, pp.150, Fig 41:4).

Lacing Up the Tooth Pendants

The Skateholm tooth pendants were attached to the sling with cordage of some sort that has decayed. We do not know what type of cord was used, of what material it was made and what kind of knots were used. No other archaeological examples of tied-on pendants exist that can serve as a guide. We were able to have a close look at two ethnographic examples from the collection of the Tropenmuseum, Amsterdam, that seemed to be related. Both were carrier bags with animal tooth pendants that, to judge from photographs, were attached in a way to allow them to move and rattle. A man's shoulder bag from one of the Papua-cultures in the Central Mountain Area in New Guinea is decorated with two clusters of pig teeth, similar to the wild boar teeth in Mesolithic Scandinavia (See Fig. 11). In both clusters two rows of teeth are overlapping, just as we planned for in the Skateholm reconstruction. When the object was scrutinized, it appeared that the teeth were not meant to be moving, primarily nor secondarily. On the contrary, in order to keep them in the desired alignment, they were fastened with stiff strips of bamboo to a stick hidden invisibly in the inside of the bag. Apparently, the visual aspect was the most important and the menacingly outward pointing teeth probably had a symbolic meaning. A second carrying bag from a Papua culture is decorated with rows of in total 72 dog tooth pendants that seem to be loosely attached, serving as a rattling ornament (See Fig. 12). A bag like this was a valued possession and was passed on by heritage, which illustrates the symbolic value the tooth decoration carried. These

appeared to be fastened on the bag by lacing, not with loops that would allow them to move freely (See Fig. 13). Here too, the visual aspect of teeth pointing outwards apparently was important and dictated the way the teeth were tied. Nevertheless, the teeth will have touched one another occasionally, as can be concluded from teeth damaged by concussion, and then probably made a rattling sound. Further study of ethnological objects with pendants tied on with the primary goal of producing a rattling sound may suggest, how to tie pendants for the desired effect.

Other ethnographic examples we studied were rattles worn while dancing, in the shape of belts, aprons, mittens, and leggings from the Americas (BM, 2016; NMAI, 2017; NMNH, 2017). On the basis of the photographs, here the hooves, claws, beaks or teeth are tied with various types of wide loops that allow the pendants to move freely. In Karl Gustav Izikowitz's book on musical instruments of South America, a number of so-called "jingle rattles" are depicted by line drawings, which show how the tying string is laced and knotted (1934, Figs. 13a–f, 14a–f). The jingles or pendants are all bell-like hollow shells tied to the edges of braided bands, but one example stands out as these pendants are made of decorated bone in a shape resembling teeth (See Fig. 14). These are tied to the lower rim of a cloth baby sling on loops that allow them to dangle (See Fig. 15). The geometric decorations of the bone pendants, as well as the rattling sound these produce, are believed to protect against evil and sorcery (Van Hout, 1993, p.86).

As the abraded, pitted areas on the traceologically studied Ajvide tooth pendants were on the sides only (See Fig. 16), we were searching for a way of tying that on the one hand allowed the teeth to move freely, but on the other hand made them touch one another on the sides only, and then made them fall back in the original position. The depictions of the "jingle rattles"-cordage in Izikowitz's book (1934, Figs. 13a–f, 14a–f) are very detailed, enabling us to replicate them with cord. This we did, trying out traditional sailor's knots as well. A large number of ceramic imitation teeth were fashioned in the shape of wild boar teeth and provided with a hole at one end. These were fastened using different cordage and different ways of tying onto leather patches that in turn were pinned to an apron of coarse linen. The apron was worn for several days while doing housework, in order to observe how the imitation teeth moved and how they sounded. It turned out that with many of the methods of knotting the teeth tangled easily because of their curved shape. The best result was gained with a plaited loop, known as the "angler's knot" or "perfect loop", when tied to the decorative and enforcing lacing (See Fig. 17). Different cordage materials were also tried. Animal materials like thin thongs, gut spliced lengthwise, or sinew fibres from hoofed animal's legs, proved not pliable enough to allow the teeth to move freely. Vegetable cord material, however, worked well. The thickness of the cord used originally is unknown, but was limited by the holes drilled in the teeth. In Mesolithic Scandinavia, cord would have been made from locally available materials, like inner bark fibres from trees and nettles (Hurcombe, 2014, pp.30–36, 48). For the Skateholm exhibit reconstruction, we used a more easily available material, flax bast cord. The knotted loops, as well as the cord used, worked as desired: the teeth dangle alongside one another without tangling, producing a rattling sound.

Listening to the Rattling Baby Pouch

The finished baby pouch is fully usable, ready to accommodate a baby or, like in our tests, a cushion in a newborn shape (See Fig. 18). When the pouch is put on and worn, the tooth pendants dangle in their suspension loops, and adjacent and underlying pendants strike one another, creating soft rattle (Sound sample 1). They also bounce off the leather and rattle again. The sound is heard especially when the leather flap is opened or folded back on the baby, or when the whole carrier is rocked to and fro using the arms and body movements. In this case the sound forms a rhythmic pattern (Sound sample 2). In the Late Mesolithic, a baby pouch with a tooth rattle was probably used in more or less the same way, to soothe a crying baby and to rock it to sleep. Perhaps the rattle was even used to accompany singing, some type of cradle song. In addition, the sound of the menacing, grimacing teeth rows could evoke the spirits of these animals and harness their forces for prophylactic purposes, in the same way as animal bones, antlers, feathers and furs or rattling hooves, claws and beaks protected shamans and other ritual performers in Siberia and North America (for example, Bittner, *et al.*, 2006). It is possible that the baby pouch found in Skateholm grave 6 never had a chance to serve in real life, but the careful, life-like arrangement of the bodies and the carrier, as well as the fish dish at the foot of the grave, suggest that the sound of the tooth rattle was thought to attend – to soothe and protect – the deceased on their way to the afterlife.

Postscript:
After completing this article, we discovered an article by Peter Vang Petersen, in which he too interprets animal tooth ornaments, found in Mesolithic graves with young children, as symbolic decorations of baby carriers:
Vang Petersen, P., 2016. Paposes in the Mesolithic? A reinterpretation of tooth and snail shell ornaments found in grave 8 at Bøgebakken and other Mesolithic burials. In: J. M. Grünberg, B. Gramsch, L. Larsson, J. Orschiedt and H. Meller, eds. *Mesolithic burials: Rites, symbols and social organisation of the early postglacial communities*. Halle: Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt. pp.109–124.

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